HW1

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1 HW 1: Regular Languages

1.1 Problem 1

Give state diagrams of DFAs for the following languages

- $\{w|w$ contains the substringab and $ba\}$
- $\{w|w$ contains an even number of 0s or exactly three 1s$\}$
- $\{w|w$ is a binary multiple of 5$\}$ Note: there's a trick to this one. As a hint there should be a total of *five* states in your DFA and only one accept state. As another hint, think about reading a binary number from left to right and how you calculate the number as an iterative process.

1.2 Problem 2

Prove or disprove the following: let D be a DFA with k-states. If the language $L(D)$ is *finite* then there exists at least one string s of length at-most $k-1$ such that D does not accept s. Hint: what do we know about a DFA if its language is finite?

1.3 Problem 3

For any string $w = w_1 w_2 \dots w_n$ then $w^R = w_n w_{n-1} \dots w_1$ is the reverse of the string. For any language A, let $A^R = \{w^R | w \in A\}$. Prove that if A is regular then so is A^R.

1.4 Problem 4

Give NFAs for the following languages

- $\{w | w$ uses all but one of $\{a, b, c, d\}\}$
- $\{w | w$ ends with a zero$\}$ but you must use only two states